show at a glance that the structure is *not* that of any Diatom.

Dictyocha.—In Dr. Gwyn Jeffreys's Report on the 'Valorous' Expedition (Proc. Roy. Soc., June 1876, p. 228), there is an account of some Diatoms examined by Professor Dickie, it being mentioned incidentally that along with these "were two *Polycystina*, namely *Dictyocha fibula*, Ehr., and *Dictyocha gracilis*, Ehr." With all deference to Prof. Dickie, I beg leave to point out that the *Dictyochidæ* are neither Diatoms, as they have been regarded by some writers, nor *Polycystina* as they would now appear to be regarded by others. They are *Rhizopods*, holding an intermediate place between *Thalassicolla* on the one hand, and the siliceous sponges on the other; and hence (as was long ago shown by me) they constitute the true connecting link between the Rhizopods and the Sponges. The basket-shaped framework of the *living Dictyocha* is never single, but invariably double, the concavities being placed face to face, and the two portions retained in position solely by the sarcode body, which fills and surrounds them. The distinct *nucleus* may always be seen, in recent specimens, suspended as it were in the middle of the sarcode, half within the boundary line of one framework, half within that of the other. The most remarkable feature, however, of *Dictyocha*, and the one which at once establishes its alliance with the siliceous sponges, is that *every* part of the siliceous framework is *tubular*.

BIBLIOGRAPHICAL NOTICES.

The Primæval World of Switzerland. With 560 Illustrations. By Professor Heer. Edited by James Heywood, F.R.S. &c. 2 vols. 8vo. Longmans & Co.: London, 1876.

The Geology of England and Wales. By Horace B. Woodward, F.G.S. &c. With coloured Geological Map and numerous woodcuts. 8vo. Longmans & Co.: London, 1876.

England and Wales have been said to exhibit an epitome of geology to the student of successive rock-formations and fossiliferous strata. From the oldest and lowest, or nearly lowest, known series of rock-masses, now much altered, to the latest or uppermost deposits of sea, lake, and river, some representative rock or layer is found in place, indicating period after period of the earth's history, as far as geologists can recognize its terraqueous existence.

Switzerland also presents an epitome of the geological history of

the world—except, 1st, that the oldest portion of the record is obscured to a greater extent by the change of strata into crystalline rocks, and, 2ndly, the marine formations of the latest period are wanting in this inland region.

As different books of history, having the same basis of facts, vary in their style and appearance, treating the subject-matter broadly or succinctly—forming a simple plain volume, or appearing with sensational pictures and embossed binding, so the first-mentioned of our natural epitomes of geology has its leaves and chapters plain and unbedecked, carrying on the student quietly from stage to stage, with but few outbursts and disturbances of events; whilst the latter, beginning with the results of great changes and *bouleversements*, has often great events to speak of, fuller series of events to describe, and better-known communities of life to introduce to notice.

The mountains, gorges, valleys, lakes, and rivers of Switzerland astonish or vaguely interest the mere tourist, give studies of lights, shades, and distances to the artist, offer many problems in physics to the exact inquirer, and, while presenting difficulty after difficulty to the geologist, at the same time help him to unravel the intricate and solve the doubtful in their structure, and thus open out the succession of events, not only among these crumpled and riven mountains, but in the gradual formation and changes of strata all over the world.

After the long series of labours carried out by eminent savants, numerous geological sections have been drawn across Switzerland, and excellent maps have been constructed. The more easterly Alpine districts also have been explored and explained by these geologists. Prof. O. Heer, in the work before us*, illustrates the old geography and hydrography of Central Europe, and its old life-groups, during successive periods, from the Carboniferous to the Quaternary, taking the known stratal conditions and collected fossils as the basis of his animated descriptions and of the pictorial illustrations with which his work is ornamented.

The oldest and much-altered rocks are known as crystalline and metamorphic, and, although now schistose, gneissic, and granitic, are referable probably to the Devonian, Silurian, and Cambrian systems, if not to the Laurentian also. They form axial masses, longitudinal and otherwise, in many parts of the Alps, having been not only folded but intensely crumpled strata, low-seated, crushed, chemically altered, and ultimately forced to a higher position by the great lateral pressure to which the whole complicated mountain-mass or *massif* was subsequently subjected. They have been here and there exposed by the destruction of the overriding schists and strata; and then they stand out as peaks and ridges, or even great rounded bosses, according to their relative hardness, and according

* The Editor states that the German and French editions were both placed in the hands of W. S. Dallas, Esq., F.L.S., for translation, and that thanks are especially due to that gentleman for the care he has bestowed on natural-history details.

as their structure is massive or laminated. Of the seas in which these oldest rocks originated, of the life-forms inhabiting the waters and lands of their times, Switzerland gives no evidence. Their hidden story is to the rest of the geological record of the Alps what the mythic period is to any human history. Everyday affairs in the one, and organic and inorganic processes in the other, may have been conducted on the same principles as at present; but the details have been obscured and are irrevocable.

The strata formed in the Carboniferous period have in many places participated in the successive foldings and squeezings of the mountain-masses; and the coal has been changed into anthracite. Much, however, remains sufficiently unaltered, in the Lower Valais and elsewhere, to supply evidence that the crystalline rocks of the Central Alps had been raised above the sea at the Coal-period, that the corals and shells are those of the Mountain-limestone elsewhere, and that the jungles and forests, which were converted into seams of coal, consisted of the great trees of the Clubmoss family (*Lycopodiaceæ*), the gigantic Calamites, and the manifold Ferns, which grew so abundantly at that time in nearly every region of the world. In Chapter I. Prof. Heer discourses with knowledge on the origin of coal, and of analogous formations of peat, paper-coal, and lignite, and on some of the plants and insects found in the shales of the Coal-measures. The succeeding Permian (or Dyas) series is represented by red sandstone, with breccia, in the valley of the Sernft or Sernif. This rock, termed *Sernifite* by M. Heer, contains copper-ores, as usual with rocks of that age.

The Swiss *Saliferous formation* is the subject of Chapter II. Here the origin of rock-salt by the desiccation of shallow seas is briefly discussed, and the Swiss salt-works described. The fossils of the Muschelkalk and especially the fossil plants found in the Keuper (Plates II. & III.) are treated of.

Chapter III. elucidates the history of the Liassic strata (the *Black Jura* of the Germans) occurring at Schembelen in the Canton of Aargau. An analogous recent formation is described as taking place at the Gongulho, Madeira. What kind of creatures the Liassic fossils once were is shown by the study of the shells, crustaceans, fishes, seaweeds, land-plants, and insects. Among the last are Cockroaches, Grasshoppers, Earwigs, Termites, Dragonflies, 114 species of Beetles (comprising such as feed on wood, fungi, leaves, flowers, dung, and carrion, and on insects and other small creatures, showing the contemporary existence of a multitude of terrestrial organisms), also Water-beetles and some other insects. Figures of many fossils determined by M. Heer are given in Pls. IV.–VIII. Some comparisons are offered of the Liassic fauna of Switzerland with that in other countries. The extent of the marine areas of the Lias and their warm climate, the fertility of the Lias and its hydrocarbon products are also noted.

The Middle and Upper Jurassic Formations ("Brown" and "White Jura" of the Germans, "Oolites" of the English, &c.) are treated of in Chapter IV., which is full of interesting information

as to Coral Islands, Coralline Limestone, and minute marine organisms of these old strata, with Sea-urchins, Ammonites, and other Shells, Turtles &c., and Seaweed. The Land-plants, Insects, and unique old Bird of the Jurassic period also occupy attention.

Together with a general table of the Swiss "Jura" (pp. 152–4), a more detailed account of the successive stages is given; also a rough chart of the Jurassic Sea in the European area, and some notes on the economic products of the Jurassic rocks.

In sketching the features and history of Central Europe during the Cretaceous Period, in Chapter V., M. Heer shows, with the help of another little map *, the changes which had taken place in the shape of the lands, from the alteration of levels and coasts. With these changes, in the course of ages, the fauna and flora also were greatly modified by variation of species or "transmutation of organic forms." The Cretaceous Cephalopods, carefully tabulated at pp. 183 & 185, are used as terms of comparison in showing the relationship of different Cretaceous areas in Europe. Other fossils are noticed, especially Seaweeds, Diatoms, Foraminifers, Echinoderms, Mollusks, &c. The distribution of Land Plants in the Cretaceous period is described with M. Heer's accurate knowledge of multitudinous specimens found in Europe, Greenland, North America, and Tropical Africa (Chargeh, west of Thebes).

The Eocene formation in Switzerland (Chapter VI.) comprises :— the curious Glaris slate, yielding many fossil Fishes, some Turtles and Birds; the *Flysch*, with its characteristic Fucoid remains and imbedded blocks of granite; the Nummulitic Limestone, containing an extensive marine fauna; and the local pea-iron-ore (Bohnerz), with mammalian bones.

The Miocene or Molasse Period of Switzerland (Chapter VII.) flourished when the land in what is now Central Europe had greatly increased, by the gradual uprising of the Alpine and other districts. Lakes had been formed, the recipients of much vegetable matter; volcanoes burst out here and there; and great accumulations of gravel were formed by mountain-torrents, and of shingle by the sea, during oscillations of land. The Miocene Flora, preserved in the lignites and plant-beds of the period, whether at home or in England, Greenland, Spitzbergen, or North America, has been a favourite study with M. Heer; so also has the Insect-fauna of the same period, at Œningen especially, where well-preserved remains of Mammals, Birds, Reptiles, Amphibia, Fishes, and other creatures also abound. These are vividly described in Chapters VIII.–XI., and comparisons are made with those of other countries. Descriptions of special localities rich in these fossils, and philosophic considerations on the probable climate of the Miocene Period, are also given. The principal results of this investigation are stated

* Like the Jurassic map above mentioned, and others that follow, this is an improved portion of one of the late M. Elie de Beaumont's palæogeographical European sketch maps.

(vol. ii. p. 147) in the following numbers, expressing approximately the temperature of the Miocene districts :—

A. *In the Earlier Miocene Epoch.*

	° Cent.	° Fahr.
1. Upper Italy (at 250 feet above the sea) had a mean annual temperature of ..	22	71·6
2. Switzerland	20·5	69
3. The basin of the Lower Rhine	18	64·4
4. The vicinity of Dantzig.....	17	62·6
5. Spitzbergen (78° N. lat.)	8	46·4

B. *In the Later Miocene Epoch.*

1. Sinigaglia	21	69·8
2. Upper Italy	20	68
3. Switzerland	18·5	65·3
4. Silesia (Schossnitz)	15	59

The Quaternary Period (newer than the Pliocene, which is not represented in Switzerland) has left the lignites of Dürnten and Utznach, formed after the Miocene strata had been tilted up with the flanks of the Alps. Their flora and fauna approximate closely to the groups now living ; but the Elephant and Rhinoceros were inhabitants of Europe. Glacial sands, gravels, and blocks lie over the lignites, and lead us direct to such natural-history and physical conditions as now rule in the highest Alps. The chapter on "Glacial History" well describes these phenomena, and connects them with the hypothetical history of the great interval between the Quaternary Period and our own day.

Chapters XIV. and XV. conclude M. Heer's work with (1) a brief view of the succession of periods and their life-groups ; (2) of the possible causes of the upheaval and depression of land during perhaps incalculable time ; (3) of the results of these movements, as shown by Switzerland, both in the formation of strata and in the conditions of the surface as eroded by water, ice, and weather ; (4) of the possible course of nature in "the remoulding of species," with regard to which, the author remarks, we are still in the dark, and which he does not consider the Darwinian theory competent to explain *.

Thus, with great skill and in a pleasant style, has the Rev. Dr. O. Heer epitomized the geological history of Switzerland, and much of Europe at the same time, keeping before us the great features of

* The editor has appended, pp. 295–302, Prof. Rütimeyer's description (with woodcut) of a group of pointed sticks and wattle or basketwork, found in an Interglacial lignite at Wetzikon, and regarded as the handiwork of primæval man. He has also given, p. 303, a comparison of English and Continental measures, weights, and thermometric scales, for the use of the student.

land and sea, faunas and floras, however much they shifted from age to age—as the scenes of a theatre, or the pictures of a magic-lantern, change under the skilful guidance of the manager, to illustrate the various turns of a story or a whole series of historic events.

Woodward's 'Geology of England and Wales' is another good book epitomizing geological history—but in this case by referring mainly to facts relating to inorganic nature, such as the various successive strata in their order, and not as to the extent and conditions of their areas of formation, and referring to fossils only as the distinctive coinage of each period, preserved in the strata, and not as directly suggestive of the animated features of the faunæ and floræ once occupying the long-since wasted regions.

After a lucid Introduction, treating of the meaning, objects, and methods of Geology, the author proceeds to describe each formation in detail, as to its topography, lithological characters, thickness, leading fossils, and economic productions. The Malvern gneiss and some other very old rocks of doubtful age serve as the basis of the Laurentian section; and the other formations follow in order, from the Cambrian (treated in the Sedgwickian sense) to the Quaternary gravels and brick-earths. The Igneous and Metamorphic rocks and Mineral Veins are separately noticed (Chapter XII.). Springs, Swallow-holes, Tufa, Caverns, Landslips, Blown Sands, Submarine Forests, Peat, Soils, and "Grey Wethers" are all briefly considered. Denudation and Scenery, and the Sections exposed by the chief Railways, are also treated of in Chapter XIII., well worthy of study. Chapter XIV., on "Geology in the Field" and other matters, should be read in connexion with the Introduction (p. 1).

Mr. Woodward's work is careful and conscientious; and he shows a healthy desire to refer directly to originators of theories and discoverers of facts; though sometimes a ready reference to the writings of his colleagues in the Memoirs of the Geological Survey has hindered his doing justice to more original notices—for instance, in the case of Swallow-holes in the Chalk, at p. 346, and the "Grey Wethers" at p. 364. Conciseness has been successfully aimed at; and yet the amateur, student, and professor will each for himself find a rich mine of facts and inferences in the short chapters of this compendious and well-conditioned book. A glossary of geological terms, a synopsis of the animal kingdom, having especial reference to fossil forms, bibliographical lists, and an excellent index satisfactorily complete the work.

In conclusion, we heartily recommend these works by Mr. Oswald Heer and Mr. Horace Woodward to geologists wishing to find the position and nature of the strata and the natural history and geography of the times of their formation. There are many points of geological detail, perhaps in every chapter of each book, that are not yet quite settled, or that at least may be further elucidated with advantage; there are omissions too, which the author's line of thought, or the plan of his work, or want of space, did not allow of

being filled up; but the general truth of the deductions is none the less for such slight imperfections. If all is not, and cannot be, yet known about transmutation of species, the great changes of climate, the origin and metamorphism of rocks, and the antiquity of man, yet the main outline of geological history has been fairly sketched to the satisfaction of inquiring minds, and is suggestive of some of the grandest ideas of which the mind of man is capable.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

April 6, 1876.—Dr. J. Dalton Hooker, C.B., President, in the Chair.

Supplemental Note to a Paper "On the Structure, Physiology, and Development of *Antedon* (*Comatula*, Lamk.) *rosaceus*." By William B. Carpenter, M.D., F.R.S.

Since my communication of the above-cited Paper to the Royal Society on the 16th December, 1875, two important contributions to the Anatomy of *Antedon* have appeared—one by Dr. Ludwig, chiefly based on his study of *Antedon Eschrichtii* ("Zur Anatomie der Crinoiden," Zeitschrift für wissenschaftliche Zoologie, Bd. xxvi. 1876, p. 361, continued in Nachrichten von der Königl. Gesellschaft der Wissenschaften und der G. A. Universität zu Göttingen, No. 5, Feb. 23, 1876), and the other by Prof. Greef, of Marburg (Sitzungsberichte der Gesellschaft zur Beförderung der gesammten Naturwissenschaften zu Marburg, January 1876), both of which seem to have been prompted by the appearance of Professor Semper's short paper on the subject. These able observers fully concur with me, as to all essential particulars, in the account I have given of the triple canal-system of the arms, which M. Edmund Perrier not only could not himself find, but ventured to predict that no one else would find; in fact, Professor Greef's figure of a transverse section of an arm might have been copied from one of the drawings I have had by me for more than ten years, save for one slight additional feature. The German investigators also accept the correctness of the statements made by me in my First Memoir, that the "nerve" of Müller is really the genital rhachis, and that Müller's "vessel" in the arms is solid, not tubular—though neither is disposed to believe with me that this "axial cord" is a nerve. The character of a nerve, on the other hand, is assigned by Ludwig to a fibrillar band lying beneath the epithelial floor of the ventral furrow of the arms; which band had been independently